PengKuan's work on Mathematics

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Note: the titles contain 2 links, the first points to the article stored in Academia and in Blogspot

1. On Fermat's last theorem

Kuan Peng,16 September 2025, « Classification of primitive Pythagorean triples »

In this article we have created the table that classifies all primitive triples, shown some properties of basic triples and discussed about the use of primitive Pythagorean triples in cryptography.

https://pengkuanonmaths.blogspot.com/2025/09/classification-of-primitive-pythagorean.html

https://www.academia.edu/143986307/Classification_of_primitive_Pythagorean_triples

File name: Classification of primitive Pythagorean triples

Kuan Peng, 16 August 2025, «Parabolic patterns in the scatter plot of Pythagorean triples»

The scatter plot of Pythagorean triples exhibits distinct parabolic patterns whose origins have not been fully characterized. In this work, we derive explicit parabolic functions directly from the Pythagorean equation and demonstrate their correspondence with these patterns. The analysis shows that basic Pythagorean triples are regularly distributed on the (X,Y) plane, occurring precisely at the intersections of horizontal and vertical parabolas. The derived functions align closely with the observed parabolic structures, and a density analysis of the parabolas explains the prominence of these patterns in the scatter plot of all Pythagorean triples.

https://pengkuanonmaths.blogspot.com/2025/08/parabolic-patterns-in-scatter-plot-of.html

https://www.academia.edu/143458666/Parabolic_patterns_in_the_scatter_plot_of_Pythagorean_triples

File name: Pattern of Pythagorean triples

Kuan Peng, July 2025 « Classification of Pythagorean triples and reflection on Fermat's last theorem»

Pythagorean triples are generated with Euclid's formula. But how this formula was derived by or before Euclid is a mystery. We have derived Euclid's formula directly from Pythagorean equation and classified all Pythagorean triples in a 3D table. The equation $X^2 + Y^j = Z^2$ is proven to have infinitely many integer solutions. By comparing Pythagorean equation with Fermat's equation for n=3 we were able to explain why Fermat's equation with n=2 has integer solutions while with $n \geq 3$ it has not. We propose an algebraic method to work Fermat's last theorem.

https://pengkuanonmaths.blogspot.com/2025/07/classification-of-pythagorean-triples.html

https://www.academia.edu/142979887/Classification_of_Pythagorean_triples_and_reflection_on_Fermats_last_theorem

File name: Pythagorean equation

Kuan Peng, July 2015 «On Fermat's last theorem»

http://pengkuanonmaths.blogspot.com/2015/07/on-fermats-last-theorem.html

https://www.academia.edu/13665056/On_Fermat_s_last_theorem

2. ND complex number and orientation

Kuan Peng, June 2024, « N-complex number, N-dimensional polar coordinate and 4D Klein bottle with 4-complex number»

Abstract: While a 3D complex number would be useful, it does not exist. Recently, I have constructed the N-complex number, which has demonstrated high efficiency in computations involving high-dimensional geometry. The N-complex number provides arithmetic operations and polar coordinates for N-dimensional spaces, akin to the classic complex number. In this paper, we will explain how these systems work and present studies on 4D Klein bottles and hyperspheres to illustrate the advantages of these systems

https://www.academia.edu/120524016/N_complex_number_N_dimensional_polar_coordinate_and_4D_Klein_bottle_with_4_complex_number

https://pengkuanonmaths.blogspot.com/2024/06/n-complex-number-n-dimensional-polar.html

Kuan Peng, 2022, «Determination of the relative roll, pitch and yaw between arbitrary objects using 3D complex number»

https://pengkuanonmaths.blogspot.com/2022/12/determination-of-relative-roll-pitch.html
https://www.researchgate.net/publication
https://www.academia.edu/92242546/Determination_of_the_relative_roll_pitch_and_yaw_between_arbitrary_objects_using_3D_complex_number

Kuan Peng, 2022, « Computing orientation with complex multiplication but without trigonometric function »

Today's methods for computing orientation are quaternion and rotation matrix. However, their efficiencies are tarnished by the complexity of the rotation matrix and the counterintuitivity of quaternion. A better method is presented here. It uses complex multiplication for rotating vectors in 3D space and can compute orientation without angle and trigonometric functions, which is simple, intuitive and fast.
https://pengkuanonmaths.blogspot.com/2022, /05/computing-orientation-with-complex.html
https://www.researchgate.net/publication
https://www.academia.edu/80277267/Computing_orientation_with_complex_multiplication_but_without_trigonometric_function

«Procedure to convert 2D formula into 3D complex formula»

https://pengkuanonmaths.blogspot.com/2022, /04/procedure-to-convert-2d-formula-into-3d.html

«Rendering of 3D Mandelbrot, Lambda and other sets using 3D complex number system»

https://pengkuanonmaths.blogspot.com/2022, /04/rendering-of-3d-mandelbrot-lambda-and.html
https://www.academia.edu/92516029/Rendering_of_3D_Mandelbrot_Lambda_and_other_sets_using_3D_complex_number_system

«Example for "Extending complex number to spaces with 3, 4 or any number of dimensions" »

https://pengkuanonmaths.blogspot.com/2022, /02/example-for-extending-complex-number-to.html
https://drive.google.com/file/d/159FE7mCrLcjGz7MXqCEvRHAKBH6sWiKX/view?usp=sharing

Kuan Peng, 2022, «Extending complex number to spaces with 3, 4 or any number of dimensions»

Multidimensional complex systems with 3, 4 or more dimensions are constructed. They possess algebraic operations which have geometrical meanings. Multidimensional complex numbers can be written in Cartesian, trigonometric and exponential form and can be converted from one form to another. Each complex numbers has a conjugate. Multidimensional complex systems are extensions of the classical complex number system.
https://www.researchgate.net/publication
https://drive.google.com/file/d/159FE7mCrLcjGz7MXqCEvRHAKBH6sWiKX/view?usp=drive_link
https://www.academia.edu/71708344/Extending_complex_number_to_spaces_with_3_4_or_any_number_of_dimensions

«Step by step rotation in normal and high dimensional space and meaning of quaternion»

The orientation of body in space is defined 3 by angles. The step by step rotation process and chain of three-dots multiplication give an easy way to compute pile of rotations in 3D and high dimensional space and give a general orientation system. A visualization of quaternion is proposed.
https://drive.google.com/file/d/1fBV4HgOg6z49yMz6Ajlx3SbPKslMNg1T/view?usp=drive_link
https://www.researchgate.net/publication
https://www.academia.edu/52628458/Step_by_step_rotation_in_normal_and_high_dimensional_space_and_meaning_of_quaternion

3. Uncountability

Kuan Peng, 2023, « Is Hilbert's Grand Hotel a paradox? »

Hilbert's Grand Hotel shows that a fully occupied hotel with infinitely many rooms can accommodate additional guests. But our analyze finds that this is not true.
https://drive.google.com/file/d/1DLMZ1hkL1VxxF3HDin7SvAvQC2FkgPY8/view?usp=drive_link
https://www.researchgate.net/publication
https://www.academia.edu/102116805/Is_Hilberts_Grand_Hotel_a_paradox

Kuan Peng, 2022, «Real numbers and points on the number line with regard to Cantor's diagonal argument»

Cantor's diagonal argument claims that ℝ is uncountable. When we see real numbers as points on the number line, we can put a name on each point and put the names into a list without contravening Cantor's diagonal argument because we cannot create a diagonal from a list of names.
However, we do not need such a impossible list, but just to split R into two parts, S2 and S10. the members of S2 are real numbers expressed in binary, those of S10 in decimal. We create a list of real numbers by picking one member from S2 and one member from S10 alternately and forever. This list is a composite list whose members are in binary and decimal alternately. The diagonal of this list is a sequence of binary and decimal digits alternately and out-of-the-list-number cannot be constructed from it.
In fact, composite list can be created in splitting R into many subsets in numeral systems of different bases from which no out-of-the-list-number can be created and there is no real number excluded from the composite list. Because the composite list is constructed from the whole R and no real number is found outside, the composite list contains R.
If there is one list that contains R we can already conclude that R is countable. But the permutation of the subsets of R can create a huge number of different composite lists which all contain R. So, we conclude with confidence that R is countable. Then Cantor's diagonal argument fails.
Cantor's diagonal argument expresses real numbers only in one numeral system, which restricts the used list. If a binary list is shown not to contain R, this can be caused either by "list" or by "binary". Because Cantor has focused only on "list" overlooking "binary", this is the flaw that breaks Cantor's diagonal argument which then does not prove ℝ uncountable.
https://pengkuanonmaths.blogspot.com/2022, /10/real-numbers-and-points-on-number-line.html
https://www.researchgate.net/publication
https://www.academia.edu/88279926/Real_numbers_and_points_on_the_number_line_with_regard_to_Cantors_diagonal_argument

Kuan Peng, 2022, « Construction of the diagonal flipped number »

We write the natural numbers 1,2,3, … in column 1,write them in binary form in column 2, invert the bits of all the numbers of column 2, the leftmost bit becomes the rightmost bit etc, then add 0. on the left of each inverted number in the column 3 to make them smaller than 1. The column 3 is the list L and does not end. As the bits of all these numbers do not ends, each number in the list L is a real number. So, L contains all the real numbers in the interval [0, 1].

https://pengkuanonmaths.blogspot.com/2022/09/construction-of-diagonal-flipped-number.html
https://www.academia.edu/86917528/Construction_of_the_diagonal_flipped_number

Kuan Peng, 2022, «Examination of Cantor's proofs for uncountability and axiom for counting infinite sets»

An analysis of Cantor's theory of uncountable sets: The logic of his proofs has some weaknesses. Cantor assumes for both his proofs that all real numbers (set R) are in a list (list L). Considering L as a set this assumption assumes R belongs to L. This makes the claim "a real number is constructed but is not in the list L" questionable. We propose a solution to this problem, an axiom for counting infinite sets and a solution to continuum hypothesis.

https://www.researchgate.net/publication/
https://drive.google.com/file/d/1FtyEhXHOnDTRwWxF-DIpWRbS10B-JFSZ/view?usp=drive_link
https://www.academia.edu/86410224/Examination_of_Cantors_proofs_for_uncountability_and_axiom_for_counting_infinite_sets

Kuan Peng, 2018, « Graphic of set counting and infinite number»

When counting a set, we can plot a graphic that represents the members of the set on the plane (x, y) to observe visually the counting. Also, graphic of counting of infinite set helps us to understand infinite natural number.

https://drive.google.com/file/d/1i4i7GS6J4a4WwKkjZIUX1OUM5zzv-LpR/view?usp=drive_link
https://www.researchgate.net/publication
https://www.academia.edu/37766761/Graphic_of_set_counting_and_infinite_number

Kuan Peng, 2018, «Building set and counting set»

A counting set is the set of natural numbers with which a countable set is put in bijection. Is the counting set for the power set of ℕ the set that builds it?

https://pengkuanonmaths.blogspot.com/2018/10/building-set-and-counting-set.html
https://www.researchgate.net/publication
https://www.academia.edu/37590687/Building_set_and_counting_set

Kuan Peng, 2018, « Analysis of the proof of Cantor's theorem »

Cantor's theorem states that the power set of ℕ is uncountable. This article carefully analyzes this proof to clarify its logical reasoning

http://pengkuanonmaths.blogspot.com/2018/09/analysis-of-proof-of-cantors-theorem.html
https://www.researchgate.net/publication/
https://www.academia.edu/37356452/Analysis_of_the_proof_of_Cantors_theorem

Kuan Peng, 2016, « Lists of binary sequences and uncountability »

Creation of binary lists, discussion about the power set of ℕ, the diagonal argument, Cantor's first proof and uncountability.

https://www.researchgate.net/publication
http://pengkuanonmaths.blogspot.com/2016/11/lists-of-binary-sequences-and.html
https://www.academia.edu/30072323/Lists_of_binary_sequences_and_uncountability

Kuan Peng, 2016, «Continuity and uncountability »

Discussion about continuity of line, how continuity is related to uncountability and the continuum hypothesis

http://pengkuanonmaths.blogspot.com/2016/11/lists-of-binary-sequences-and.html
https://www.researchgate.net/publication
https://www.academia.edu/28750869/Continuity_and_uncountability

Kuan Peng, 2016, «Cardinality of the set of decimal numbers »

Cardinalities of the set of decimal numbers and ℝ are discussed using denominator lines and rational plane.

https://www.academia.edu/23155464/Cardinality_of_the_set_of_decimal_numbers
http://pengkuanonmaths.blogspot.com/2016/03/cardinality-of-set-of-decimal-numbers.html
https://www.researchgate.net/publication

Kuan Peng, 2016, «Prime numbers and irrational numbers »

The relation between prime numbers and irrational numbers are discussed using prime line and pre-irrationality.

http://pengkuanonmaths.blogspot.com/2016/02/prime-numbers-and-irrational-numbers.html
https://www.academia.edu/22457358/Prime_numbers_and_irrational_numbers

Kuan Peng, 2016, « On Cantor's first proof of uncountability»

Discussion about Cantor's first proof using the next-interval-function, potential and actual infinity.

https://www.researchgate.net/publication/
http://pengkuanonmaths.blogspot.com/2016/02/on-cantors-first-proof-of-uncountability.html
https://www.academia.edu/22104462/On_Cantors_first_proof_of_uncountability

Kuan Peng, 2016, «On the uncountability of the power set of ℕ»
This article discusses the uncountability of the power set of ℕ proven by using the out-indexes subset contradiction.
https://www.researchgate.net/publication
http://pengkuanonmaths.blogspot.com/2016/02/on-uncountability-of-power-set-of.html
https://www.academia.edu/21601620/On_the_uncountability_of_the_power_set_of_N

Kuan Peng, 2016, « Hidden assumption of the diagonal argument»
This article uncovers a hidden assumption that the diagonal argument needs, then, explains its implications in matter of infinity.
https://www.academia.edu/20805963/Hidden_assumption_of_the_diagonal_argument
https://www.researchgate.net/publication/
http://pengkuanonmaths.blogspot.com/2016/01/hidden-assumption-of-diagonal-argument.html

Kuan Peng, 2016, «Which infinity for irrational numbers? »
This article clarifies the kind of infinity used to quantify the number of digits of irrational numbers and try to check the cardinality of decimal numbers.
https://www.academia.edu/20147272/Which_infinity_for_irrational_numbers
https://www.researchgate.net/publication/
http://pengkuanonmaths.blogspot.com/2016/01/which-infinity-for-irrational-numbers.html

Kuan Peng, 2015, «Continuous set and continuum hypothesis»
This article explains why the cardinality of a set must be either $\aleph_0$ or $|\mathbb{R}|$.
https://www.researchgate.net/publication/
http://pengkuanonmaths.blogspot.com/2015/12/continuous-set-and-continuum-hypothesis.html
https://www.academia.edu/19589645/Continuous_set_and_continuum_hypothesis

Kuan Peng, 2015, «Cardinality of the set of binary-expressed real numbers»
This article gives the cardinal number of the set of all binary numbers by counting its elements, analyses the consequences of the found value and discusses Cantor's diagonal argument, power set and the continuum hypothesis.
https://www.researchgate.net/publication/
https://www.academia.edu/19403597/Cardinality_of_the_set_of_binary-expressed_real_numbers
https://www.academia.edu/19403597/Cardinality_of_the_set_of_binary-expressed_real_numbers

4. On Fermat